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RPPR Final Report
as of 06-Dec-2018

Agency Code:

Proposal Number: 70495ELREP
INVESTIGATOR(S):

Agreement Number: W911NF-17-1-0472

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Final Report for Period Beginning 05-Sep-2017 and Ending 04-Sep-2018

Title: High Speed Optoelectronic Device Characterization System

Begin Performance Period: 05-Sep-2017

End Performance Period: 04-Sep-2018

Report Term: 0-Other

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Distribution Statement: 1-Approved for public release; distribution is unlimited.

STEM Degrees:

STEM Participants:

Major Goals: The research objective is to explore the physics and engineering of optical cavities and membrane printing processes for high performance high speed energy efficient photonic devices, especially membrane lasers, through hybrid integration of nano-scale materials (crystalline semiconductor nanomembranes and novel 2D materials) with photonic crystal and metamaterial cavities.

Funding is requested to purchase Keysight N4357D 26.5 GHz single-mode lightwave component analyzer (LCA) and associated source/voltage test units for high-speed membrane laser research, as well as other extreme photonic devices and integrated chip testing.

Accomplishments: With this equipment funding support, we acquired a Keysight N4357D 26.5 GHz single-mode lightwave component analyzer (LCA) and associated source/voltage test units for high-speed membrane laser research, as well as other extreme photonic devices and integrated chip testing. The N4375D LCA is based on the new 4-port N5222A PNA Series microwave network analyzer with high RF output power. This enables both small signal analysis and large signal analysis on device under test.

Training Opportunities: Nothing to Report

Results Dissemination: Nothing to Report

Honors and Awards: Nothing to Report

Protocol Activity Status:

Technology Transfer: Nothing to Report

RPPR Final Report
as of 06-Dec-2018

Final Report

Submitted to ARO Program Manager Dr. Michael Gerhold

Project: DoD HBCU/MI Equipment Program

Agreement Number: W911NF-17-1-0472

Report Date: Mar 2016 (For the period of Sept. 5, 2017 to Sept. 4, 2018)

Title: High Speed Optoelectronic Device Characterization System

PI: Prof. Weidong Zhou, University of Texas at Arlington (UTA) 500 S. Cooper St., Arlington, Texas 76019-0072; Tel: 817-272-1227; Email: wzhou@uta.edu;

With this equipment funding support, we acquired a *Keysight N4357D 26.5 GHz single-mode lightwave component analyzer (LCA)* and associated source/voltage test units for high-speed membrane laser research, as well as other extreme photonic devices and integrated chip testing. The N4375D LCA is based on the new 4-port N5222A PNA Series microwave network analyzer with high RF output power. This enables both small signal analysis and large signal analysis on device under test. 1310 nm and 1550 nm laser sources were included in the system for modulators and detector measurement at these wavelengths. The system is capable of high speed laser characterization.

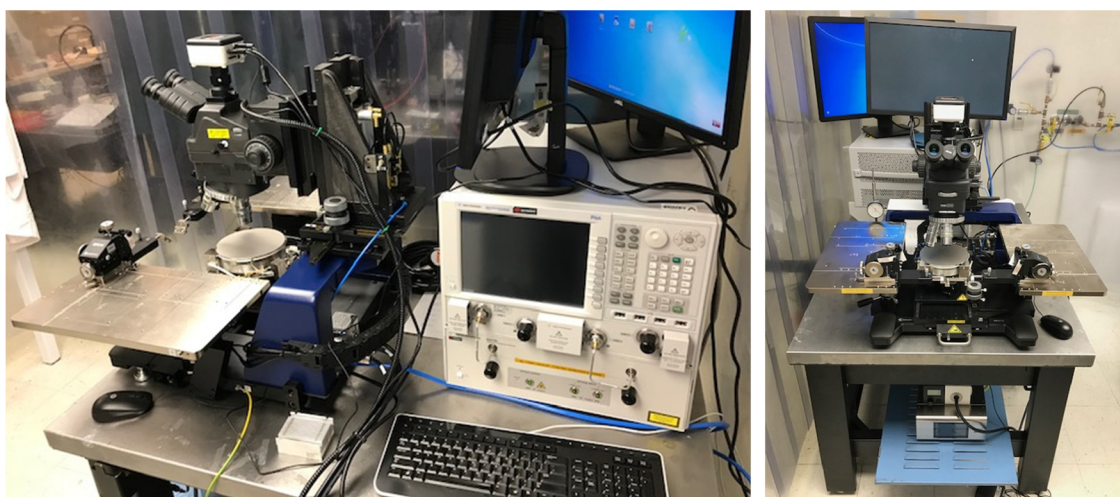


Figure 1 Keysight N4357D 26.5 GHz single mode lightwave component analyzer with Formfactor MLS 150 probe station for high speed optical characterization.

A MPS150-M Probing System is also purchased with a dedicated 150 mm thermal chuck with temperature control range of 30°C to 200°C. The probe station also includes WinCalXE software package for on-wafer RF measurement calibration for high accurate and repeatable S-parameter measurement.

In addition, we also acquired a Montana Instrument Cryostation (Figure 2), which can be used for over temperature measurement with temperature down to 3.6 K and high temperature stability and extremely low vibration, A high speed GSF RF probe was also included inside the sample chamber for over temperature high speed measurement.

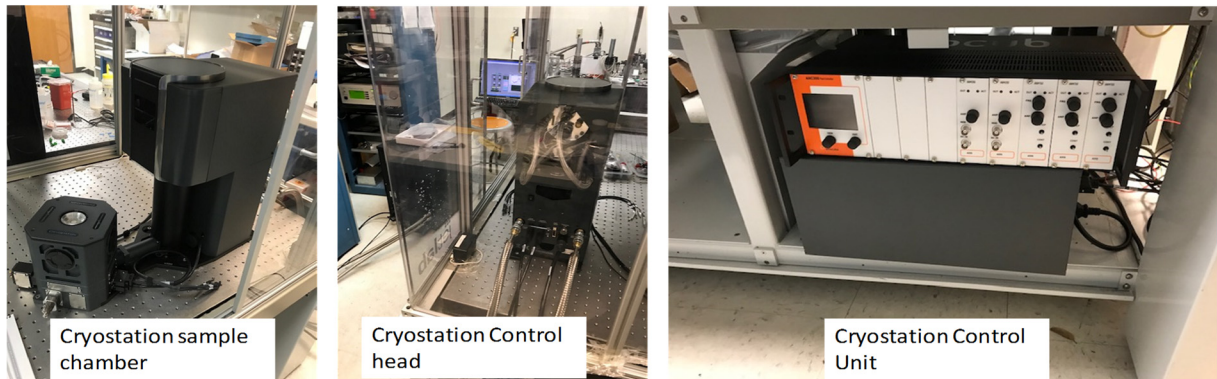


Figure 2 Montana Instruments Cryostation installed in our lab..

Complete list of equipment and software purchased with this project fund:

Items	Company	Qty	Product	Description
A	Keysight N4375D 26.5 GHz Lightwave Component Analyzer			
	Keysight	1	N4375D-102	Optical test 1310 1550
		1	N4375D-421	26G module demo
		1	M4375D-050	External optical input
		1	M4375D-S10	Time domain measurement
		1	N4691B	Ecal module
		2	N4373-61604	cables
B	Montana Instruments		Cryostation Fusion F2 3K-350k optical cryostat system	
			RF probe add-on	
C	Form Factor		Cascade M150 RF Probe Station	
			GSG probes	
D	Olympus		ORCA-R2 CCD Camera	
E	Thorlabs	1	S5FC1550S-A2	Fiber coupled SLD Source 1520-1580 2mW
F	Newport		LDP3811	500 mA Pulsed/CW Laser Diode Current Source
G	Rsoft			LaserMOD laser design software package
				Software IDC

Major Accomplishments:

- (1) Complete system installation;
- (2) Integrated this system with various pieces of optical testing equipment, including light source, monochromator, optical spectral analyzer, detectors, and probes. Will be used for a wide range of optoelectronic devices and integrated systems research.
- (3) Near term plan: we will be testing some VCSEL devices from our collaborators' groups to evaluate small signal modulation properties over different temperature ranges.
- (4) More research work is being carried out on these tools for high speed laser, modulator, and detector research.

Research and Educational Project for which the equipment to be used:

- (1) **High Speed High Efficiency QD Laser and VCSELs:** The tool enables two objectives of the research project: **Objective 1:** Scaling of semiconductor nanomembrane lasers towards extreme energy efficient integrated photonics/electronics, with applications in communications, computing, sensing, imaging, etc. **Objective 2:** Investigation of VCSEL devices to understand its intrinsic limitations by carrying out over temperature frequency modulation studies.
- (2) Student training: These versatile experimental setups will serve as the power tool for the student training for both graduate and undergraduate students.
- (3) This new system can drastically boost the nanoscale-related research and STEM education capabilities at UTA, and to attract more students from under-represented groups into STEM careers. It will provide critical research training in the area of nanophotonics, optoelectronic and electronic materials, devices and systems for undergraduate and graduate students participating on the related research projects. Having such highly trained individuals in the workforce is critical to the economic well-being of the United States in both defense-related and other commercial industries that compete in the global marketplace. Thus the equipment system proposed for purchase here will have direct and positive impact on the research training of both undergraduate and graduate students supported by this project in multi-disciplinary areas that are core of critical importance to DoD.